Geographic Specificity, Tornados, and Protective Action

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Research Objectives

The Disaster Research Center (DRC) at the University of Delaware collected telephone interview data during the 2008, 2009, and 2010 USA tornado seasons, with the goal of better understanding public response to tornado and severe storm warnings by bringing together issues from social and weather sciences. Using this data, the following study examines the relationship between warning polygons, storm tracks, household location, socio-demographics and protective action decisions. With advances in technology, the NWS has placed particular attention on geographic precision of tornado warnings. In fact, in 2007 they began using more geographically specific storm based warnings. Still work must be done on developing stronger linkages between the warning system policies and our understanding of public response to these warnings. There have been few detailed studies examining behavioral response to tornado warning, especially with the focus on decision-making. Of the ones that exist, several relevant variables and ideas have emerged from which we build our hypotheses.

Hypotheses

Location Relative to Warning Polygon

Being inside warning polygon increases likelihood of taking some type of protective action.

Being inside warning polygon increases likelihood of taking shelter.

Being inside warning polygon reduce likelihood of seeking information.

Size of Warning Polygon

Smaller warning polygon, less likely to seek more information.

Smaller warning polygons, more likely to take protective action, and in particular take shelter.

Proximity to Tornado

Closer to the tornado track, more likely to take shelter.

Variable Descriptives

		N	%
Type of Protective Action	**Nothing**	51	12.9%
	Seek More Information	152	38.6%
	Protect Property	33	8.4%
	Shelter	158	40.1%
Track Proximity	**Beyond 5 Miles**	207	52.5%
	Within 5 Miles	187	47.5%
Warning Polygon	**Outside**	136	34.5%
	Inside	258	65.5%
Polygon/County Ratio	**>= 50%**	135	34.3%
	< 50%	259	65.7%
Race	**White**	327	83.0%
	Non White	67	17.0%
Gender	**Male**	127	32.2%
	Female	267	67.8%
Education	**High school or less**	160	40.6%
	Beyond high school	234	59.4%
Family Plan	**No**	200	50.8%
	Yes	194	49.2%
Past tornado experience	**No**	168	42.6%
	Yes	226	57.4%
Valid		394	100.0%
Missing		644	
Total		1038	

Results and Conclusions

Storm based warnings

We were not able to conclude that being inside the polygon actually led to protective action. We hypothesize that this could be due to dissemination and reception of the polygons. Past literature agrees, people may not always understand that they are actually in a warning polygon. On the other hand, the size of the polygon did seem to have an impact on protective action. Those within a smaller polygon were indeed more likely to take some protective action and in particular, shelter.

Track Proximity

Being closer to the tornado track, made people much more likely to take shelter. We hypothesize that the close proximity allows for greater personalization of risk and provides an opportunity to visually confirm the presence of a threat. Though we can't fully explain the reasons behind this relationship, it does suggest that geographic specificity is important.

Socio-demographics and preparedness

As controls we included socio-demographic and preparedness variables. Contrary to past research, age, race, gender, and education did not seem to have an impact on protective action decision making. Also, contrary to previous findings, past experience with the hazard was not a significant variable. In agreement with other studies, the existence of a family emergency plan made people more likely to seek more information, protect property, and shelter.

Simple Protective Action Regression

Any Protective Action?		B	Error	Sig.	Exp(B)
Did Something	**Intercept**	3.316	.692	.000	
	Age	-.007	.010	.463	.993
	Outside Warning Polygon	.314	.401	.433	1.369
	Polygon >= 50% of the County	-.687	.322	.033	.503
	Beyond 5 Miles	-.627	.385	.104	.534
	White	.259	.401	.519	.772
	Male	.245	.350	.485	1.277
	High School or less	.232	.331	.483	1.261
	No Family Plan	-.944	.335	.005	.389
	No Past Tornado Experience	-.052	.315	.869	.950

Type of Protective Action Regression

Type of Protective Action		B	Error	Sig.	Exp(B)
Seek More Information	**Intercept**	2.332	.740	.002	
	Age	-.012	.011	.251	.988
	Beyond 5 Miles	-.272	.419	.516	.762
	Outside Polygon	.524	.430	.223	1.688
	Polygon >= 50% of County	-.652	.349	.062	.521
	White	.352	.441	.426	.704
	Male	.452	.372	.224	1.572
	High School or less	.417	.356	.241	1.517
	No Family Plan	-.924	.357	.010	.397
	No Past Tornado Experience	-.035	.339	.917	.965
Protect Property	**Intercept**	.060	1.011	.953	
	Age	-.002	.015	.885	.998
	Beyond 5 Miles	-.185	.541	.732	.831
	Outside Polygon	-.277	.605	.647	.758
	Polygon >= 50% of County	.055	.473	.908	1.056
	White	.520	.633	.411	.595
	Male	.576	.488	.238	1.779
	High School or less	.248	.484	.609	1.282
	No Family Plan	-1.138	.475	.017	.320
	No Past Tornado Experience	.463	.463	.317	1.590
Shelter	**Intercept**	2.815	.742	.000	
	Age	-.004	.011	.742	.996
	Beyond 5 Miles	-1.080	.423	.011	.340
	Outside Polygon	.245	.448	.584	1.277
	Polygon >= 50% of County	-.888	.353	.012	.412
	White	.091	.440	.836	.913
	Male	-.091	.382	.811	.913
	High School or less	.030	.358	.933	1.031
	No Family Plan	-.919	.358	.010	.399
	No Past Tornado Experience	-.196	.340	.565	.822

- Significant at the 0.05 level (2-tailed).
- Significant at the 0.01 level (2-tailed).

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